GSM-1 User Manual

rev. 1.02
(applies to GSM-1 v3.0.0 and CyPro 2.5.6 and later)

cybroTech

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Overview

GSM-1 is GSM/GPRS module for CyBro-2. It provides three basic functions:

SMS
- reading and writing PLC variables
- alarming, send SMS when trigger variable is set

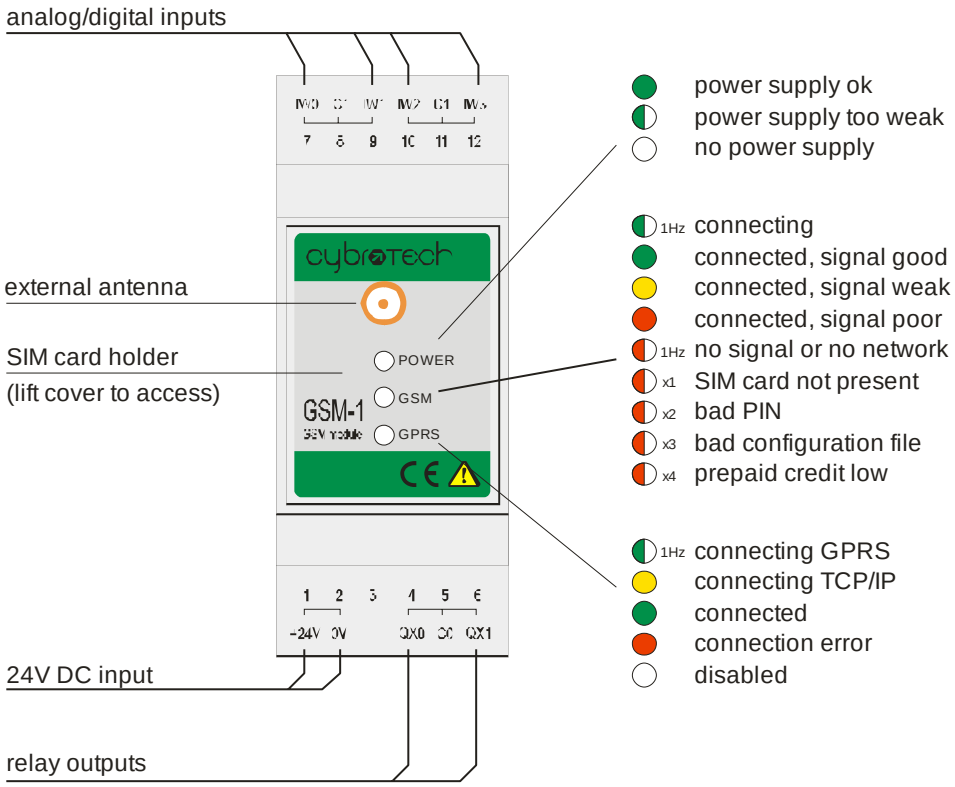
Voice
- call module to perform an action
- module will perform a call when condition is satisfied

GPRS
- remote programming and monitoring using CyPro
- remote data transfer using CyBro OPC server

GSM-1 connects directly to IEX bus, together with other i/o modules. CyBro serial port is not used. To use GSM-1, no programming is needed. Set a few configuration options, and module is ready.

Hardware:

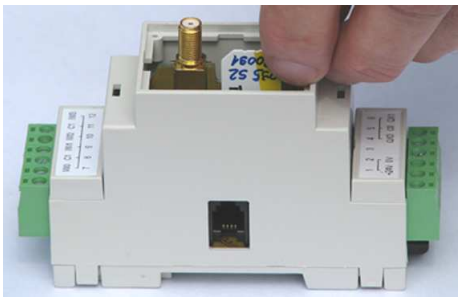
- three-band 900/1800/1900MHz
- internal GSM antenna
- external antenna connector (SMA type), automatic switch
- 4 analog/digital inputs
- 2 relay outputs



Quick setup

1. Insert SIM

- Open front cover and insert SIM in card holder.



2. Edit configuration file

Edit configuration file (CyPro/Examples/GsmDemo.ini) according to your data:

Common

- Enter PIN number for your SIM card. Comment SimPin line if PIN is disabled.

```
[GSM]
SimPin=1234
```

Voice

- Enter your mobile phone number in OutgoingPhones group.

```
[OutgoingPhones]
+385919146308
```

GPRS

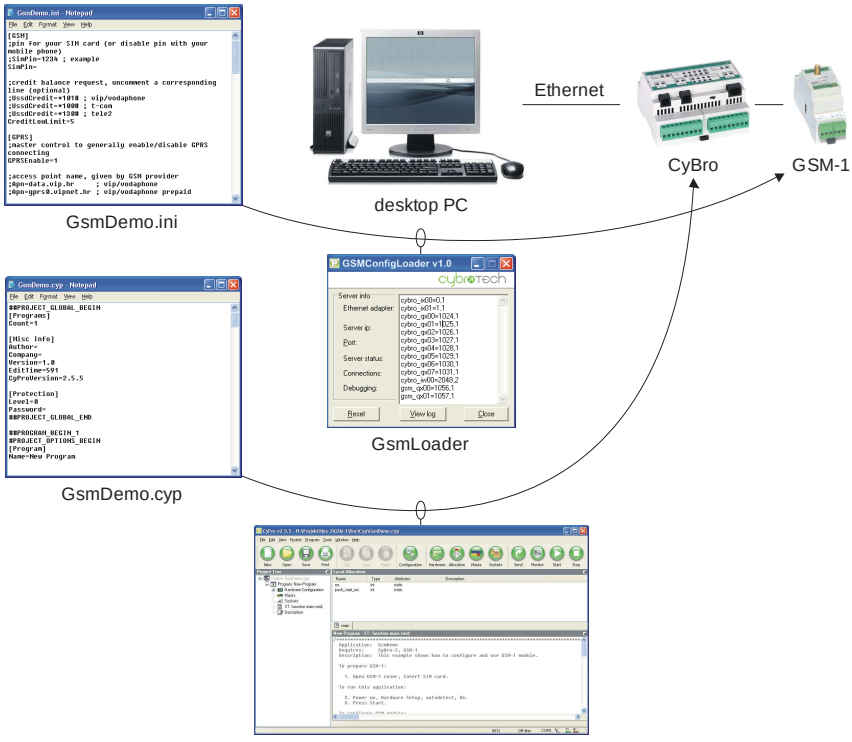
- Make sure that SIM card is data-enabled. Ask GSM provider for details.
- Set Apn, UserId, Password and DnsIp according to data provided by your GSM operator.
- Set NAD to network address of your CyBro. Use serial number, not alias.
- Set PushIp to IP address (or domain name) where push message should be sent.

```
[GPRS]
Apn=data.vip.hr
UserId=38591
Password=38591
DnsIp=212.91.97.3

[Push]
NAD=8031
PushIp=myhome.getmyip.com
```

3. Send configuration file

- Connect CyBro, GSM-1, power supply and ethernet.
- Start GsmLoader, select CyBro and GSM-1.
- Open your GsmDemo.ini and send it.
- Start CyPro.
- Open GsmDemo.cyp, autodetect and start.



After transfer is complete, module will reset automatically. Minute or two later, it will connect to network, and both GSM and GPRS LEDs will be green. If configuration file has errors, GSM LED will signalize by blinking red, 3 times every 2 seconds.

4. Check operation

SMS

- Send SMS "cybro_qx00=1" to GSM-1.

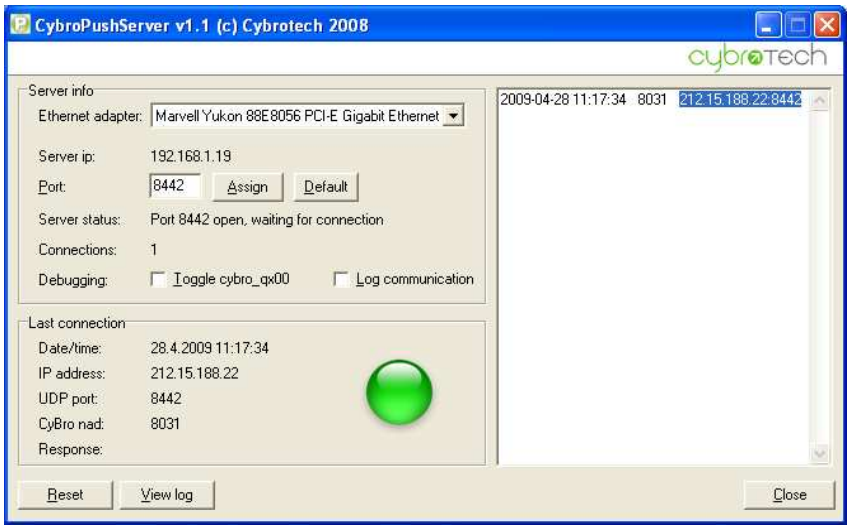
After a few seconds, relay will turn on. Confirmation message will be received soon.

Voice

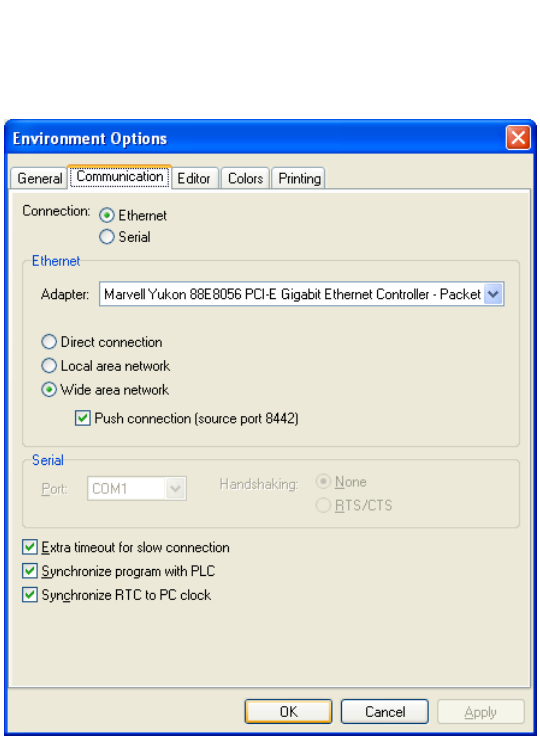
- Open variable monitor.
- Call GSM-1 from your mobile phone.
- Variable gsm_incoming_call becomes 1, and gsm_incoming_rings increments on each ring.
- Set gsm_outgoing number to 0, and gsm_outgoing_call to 1. Your phone will ring.

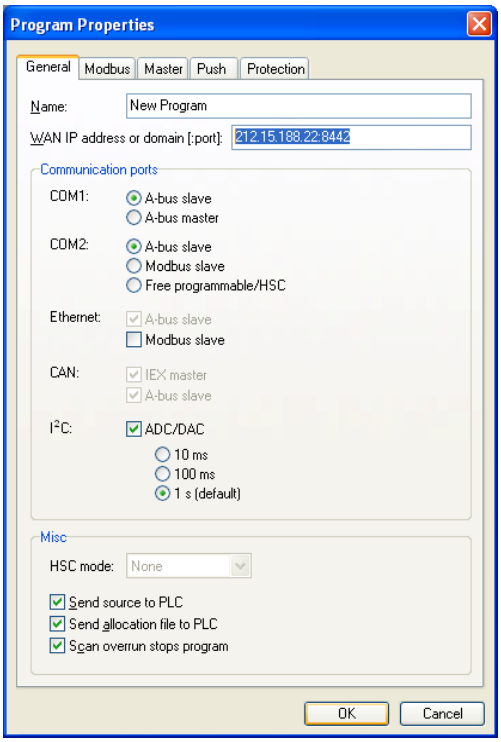
GPRS

- Make sure GSM module is configured for your WAN address.
  To check your WAN address, visit http://www.whatismyip.com/ or similar site.
- Open configuration page of your router, forward UDP port 8442 to your PC.
- Start CyBroPushServer, wait until push message appears.



- Note ip address and port number, and close CyBroPushServer (don't skip this).
- Start CyPro, open GsmDemo.cyp.
- Configure communication for WAN, using push port. Turn on Extra timeout for slow connection.
- Open Configuration and enter previously noted ip address and port number.



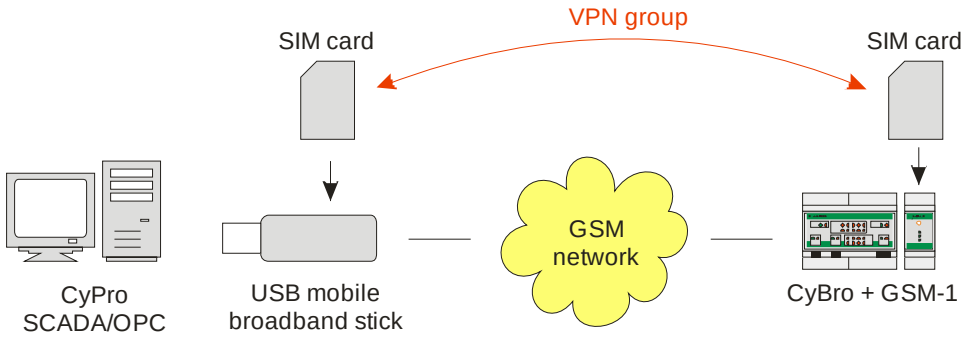


Status bar will show when communication is established.

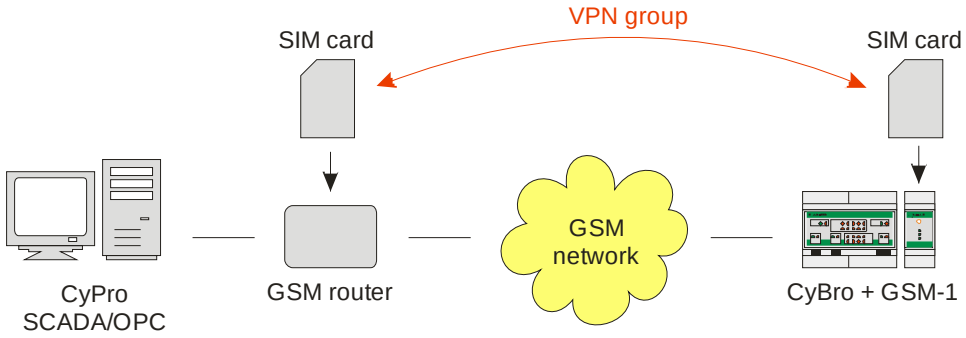
Connection options

A few examples how to connect GSM-1 into a system.

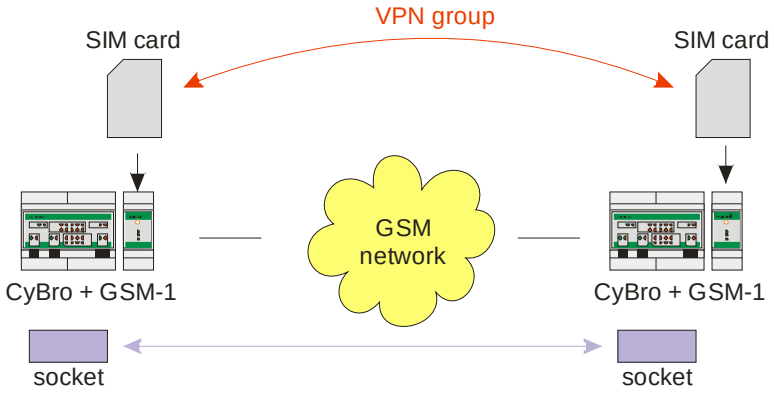
1. PC-CyBro using VPN SIM cards



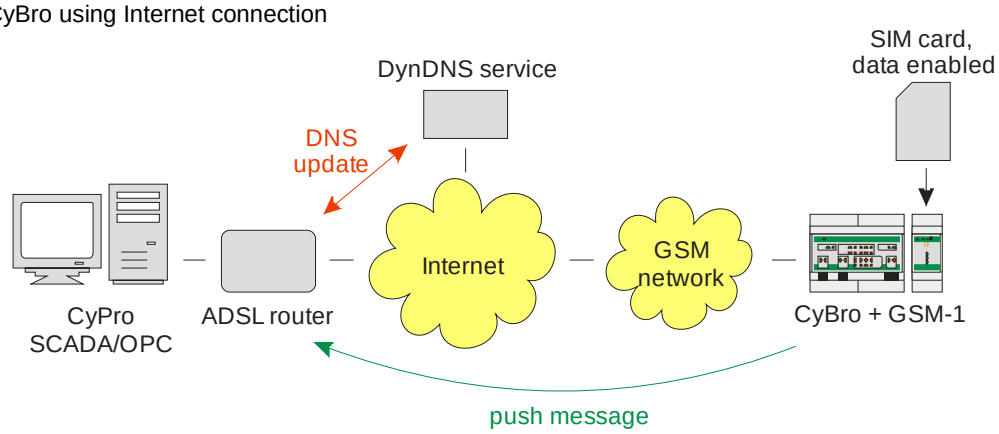
2. PC-CyBro using GSM router and VPN SIM cards



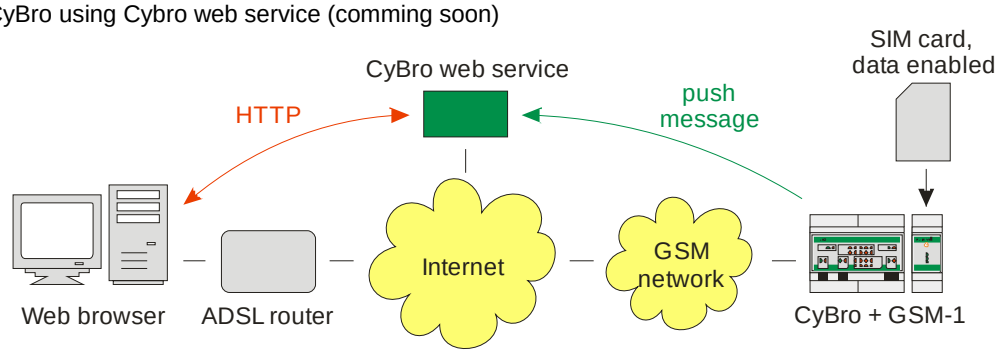
3. CyBro-CyBro using VPN SIM cards (comming in next release, software update only)



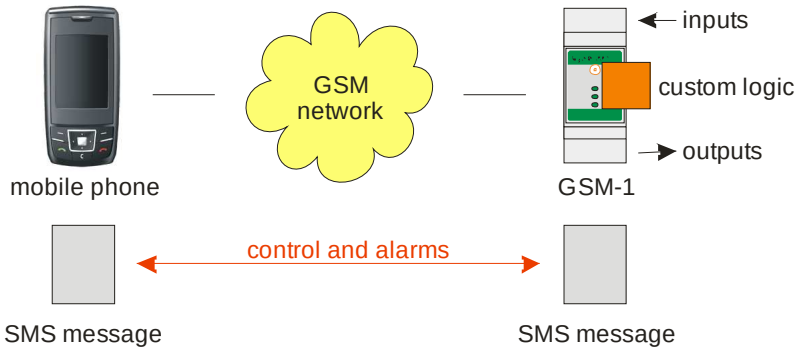
4. PC-CyBro using Internet connection



5. PC-CyBro using Cybro web service (comming soon)



6. Stand-alone operation (available on request, software update only)



Configuration

Description

GSM-1 operates as CyBro-2 external i/o module. Unlike other modules, only one GSM-1 can be connected to CyBro.

GSM-1 configuration is defined by text file, ini format. To edit, use any standard text editor (e.g. Notepad). To send file, use program GSMLoader. Maximum size of configuration file is 14Kb.

Module should be configured according to plc program. When plc allocation is changed, GSM configuration should be modified accordingly.

Syntax rules:

The basic element contained in a file is parameter that has name (tag), and value delimited by equal sign (=). The name appears to the left of the equal sign. Tag must appear on line by itself.

All parameters are contained in groups (sections). The group name appears on a line by itself, in square brackets ([and]). All parameters after the section declaration are associated with that section.

Semicolons (;) indicate comment. Comments continue to the end of the line. Everything between semicolon and end of line is ignored. Special or national characters are not allowed, and may cause parsing errors.

Configuration file

Common

[GSM]
SimPin=<pin>
UssdCredit=<credit request string>
CreditLowLimit=<amount of money>

SimPin is needed if PIN of your SIM card is not disabled.

UssdCredit (the string for checking credit limit defined by gsm operator) and CreditLowLimit (low limit credit amount) are needed when user wants to be warned if credit balance is critically low. The module will check credit limit once per hour. If UssdCredit doesn't exist, credit checking is turned off.

Note: Be aware that prepaid SIM credits have limited period of validity, expiring of which module can't detect. When in doubt, check SIM in your mobile phone.

[IncomingPhones]
IncomingPhones contains list of telephone numbers (international format, beginning with '+'), which are allowed to perform operations by calling or sending SMSes to module. If group doesn't exist, everybody is allowed to perform operations. If group exists, but it is empty, no one will be able to access module. Example:

```
[IncomingPhones]
+38591123456
+385981234567
```

[OutgoingPhones]
OutgoingPhones contains list of telephone numbers (international format, beginning with '+'), which will be called or to which SMSes will be sent in case of an alarm. Example:

```
[OutgoingPhones]
+38591123456
+385981234567
```

SMS read/write

[SMS]
ControlAck tag defines weather SMS write confirmation is sent or not.

[CybroVars]
This group contains CyBro variables accessible for reading/writing by SMS, or used as a content of SMS alarm (not trigger). To get variable address, check alc file. If alc doesn't exist, check Automatically save allocation file in Environment options. Addresses in alc file are hexadecimal, and should be manually converted to decimal. Types are 1-bit, 2-int, 3-long and 4-real. Example:

```
[CybroVars]
cybro_qx00=1024,1
cybro_iw00=2048,2
my_counter=6144,3
```

Alarm function

[SMSAlarmTrigger]
[SMSAlarmText]
Those groups, together with OutgoingPhones, define SMS alarms. Example:

```
[SMSAlarmTrigger]
1024
1025

[SMSAlarmText]
Alarm: fire in cellar! CO=%co_measured_percent:1%
Alarm: valve %valve is broken! Pressure is %pressure:2
```

Voice function

[Voice]
RxHangup tag defines if an incoming call is rejected after the first ring.

GPRS function

```
[GPRS]
GPRSEnable=1    ; Global control to eanble or disable GPRS.
Apn=gprs0.vipnet.hr
UserId=38591
Password=38591
DnsIp=212.91.97.3
```

Apn, UserId, Password and DnsIp are provided by GSM operator.

```
[Push]
NAD=8031          ; CyBro NAD (serial number, not alias).
PushIp=89.1.3.96; IP address or domain name to which push is sent.
PushPort=8442    ; Port to which push is addressed, use 8442.
PushPeriod=60    ; Period of the push repetition in seconds.
```

Push group defines push message. Purpose of push message is to get ip address of CyBro.

I/O variables

Input/output

gsm_ix00..gsm_ix03 - digital inputs, 0-off, 1-on
gsm_iw00..gsm_iw03 - analog inputs, potentiometer or voltage 0..10V (0..1023)
gsm_qx00..gsm_qx01 - relay outputs, 0-off, 1-on

note: digital and analog inputs are physically the same

Status bits

gsm_general_error - one or more system errors occurred (timeout, program or bus error)
gsm_timeout_error - communication failed, no messages are coming from the module
gsm_program_error - internal or configuration error detected, module is not functional
gsm_bus_error - module detected a number of communication errors, but it is still working

gsm_connected - module connected to GSM network (domestic or roaming)
gsm_roaming - domestic network not found, roaming connected
gsm_gprs_connected - module connected to GPRS network

Status words

gsm_error_status - module status: b7:voice_tx_error, b6:SMS_tx_error, b5:udp_tx_error, b4:no_credit, b3:config_error, b2:PIN_error, b1:sim_error, b0:network_denied
gsm_gprs_status - status of GPRS network registration (0..7-connecting, 8-connected, 9..11-error)

Module info

gsm_signal_quality - GSM signal quality, range 0..31 (0..7 poor, 8..14 acceptable, 14..31 good)
gsm_credit_balance - credit balance in local currency for prepaid SIM card (e.g. 24 means 24EUR), checked every 60min, always zero for postpaid.

Incoming voice call

gsm_incoming_call - incoming call active, 1-ringing, 0-hangup
gsm_incoming_rings - number of incoming rings, reset when receiving a call, counting up with each ring
gsm_incoming_number_0.._7 – incoming phone number, last 16 digits, right aligned

Outgoing voice call

gsm_outgoing_number - index of phone number to be called; 0 for first number in the list, 1 for 2nd, 2 for 3rd...
gsm_outgoing_call - activates outgoing voice call (1-calling, 0-hangup)

Push message

gsm_push_message_req - request to send push message

Detailed explanation

SMS read/write

SMS control function provides reading and writing PLC variables with commands sent by SMS.

Read commands are given in following format: <variable>=?
Write commands are given in following format: <variable>=<value>

Command line may contain multiple commands, separated by spaces. Mix of reading and writing is supported.

If reading succeeds, read value is returned. If writing succeeds, read value and 'OK' is returned, but only when ControlAck in SMS group is 1. If reading/writing fails, for any reason (wrong variable name or other error), ERR is returned.

Module perform writes first, then follow reads. Result is always actual CyBro value obtained by reading.

Read variable:

```
send:
a=?
receive ok:
a=5
receive err:
a=ERR
```

Write variable:

```
send:
a=5
receive ok:
a=5 OK
receive err:
a=ERR
```

Multiple reads and writes:

```
send:
a=? b=22 c=? d=35
receive:
a=11 b=22 OK c=ERR d=30 OK
```

In this example, variable c doesn't exist and variable d is limited to 30 by PLC program.

If SMS functionality is not working, check your SIM card, it's possible that card is data-only.

Alarm function

When triger variable is set to 1, related SMS will be sent. After getting request, module will automatically write 0 to trigger variable.

Triggers, messages and phone numbers are located in separate groups:

```
[SMSAlarmTrigger]
1024
1025

[SMSAlarmText]
The quick brown fox jumps over lazy dog.
The slow yellow dog jumps over tired fox.

[OutgoingPhones]
+491112345678
+491112345678
```

First trigger is related to first message/number, second trigger to second message/number and so on.

SMS message may show value of CyBro variables. Format is %<variable name>[:<d>]. Variables are located in [CybroVars] group.

If <variable name> is defined, value will be sent, otherwise percent sign and following characters will be sent as text.

The number of decimal places can be specified with :<d>, where d is a single digit number. Integer variables are divided by 10 for each decimal place. Real variables are printed as-is. If the number of decimal places is not specified, reals will default to 6 decimal digits.

Note: if trigger variable is permanaltly forced to 1 by plc program, GSM-1 will send SMS messages repeatedly.

If SMS functionality is not working, check your SIM card, it's possible that card is data-only.

Incoming voice call

When incoming call is received, variable gsm_incoming_call is set. When call is ended, variable will reset automatically. Variable gsm_incoming_rings is incremented on each ring. It will retain value until next call, then it will restart with first ring. In consequence, it will never again reach zero.

Last 16 digits of the incoming number are written in 8 integer variables: gsm_incoming_number_0 ... gsm_incoming_number_7. Leftmost digit is stored in high byte of 0, rightmost in low byte of 7.

If RxHangup in Voice group is set, call is rejected after the first ring.

If voice call is not working, check your SIM card, it's possible that card is data-only, with no voice capabilities.

Outgoing voice call

Outgoing voice call can be activated by PLC program as follows:

- write phone number index to gsm_outgoing_number
- set gsm_outgoing_call to 1

To stop calling, plc program should reset gsm_outgoing_call. If variable is set permanently, GSM-1 will continue to make calls repeatedly, it will never automatically reset the variable.

If voice call is not working, check your SIM card, it's possible that card is data-only, with no voice capabilities.

Technical specifications

GSM module	three-band 900/1800/1900MHz
GPRS class	mobile station class B
Antenna	internal or external
Connector type	SMA with automatic switch
External antenna	50 Ohm nominal
Input type	digital / analog 0..10V
Internal pull-up	12V, 2mA
Analog readout	0..1023
A/D converter	10-bit
Accuracy	5% FSR at 25℃
Update time	5ms typ.
Output type	relay contact, normally open
Load	max. 3A/250V AC or 3A/30V DC, resistive
Update time	5ms typ.
Power supply	24V DC (18-26V)
Power consumption	75mA standby, 100mA active
Operating conditions	0..50℃, 0..85% rh non-condens ing
Dimensions	36x99x70mm

Mounting

When operating on internal antenna, it is recommended to mount GSM-1 away from CyBro and other modules. Placing on opposite side of cabinet will provide better signal, and more stable communication.

Class B operation

GSM-1 is GPRS mobile station class B, as most GPRS mobile devices. It can be connected to GSM and GPRS service at the same time, but can use only one or the other at a given time.

During GSM service (voice call or SMS), GPRS service is suspended, and then resumed automatically after the GSM service is concluded. Practical consequences are:

- receiving SMS is postponed and voice calls are blocked while GPRS is active (outgoing SMS is not affected)
- remote GPRS connection is not possible while voce call is active

LED signalization

POWER
on - module is connected to 24V power supply
blinking - unstable power supply or device malfunction
off - no power supply.

GSM
green blinking, 1 per second - connecting
green - registered to domestic GSM network, good signal quality
yellow - registered to domestic GSM network, acceptable signal quality
red - registered to domestic GSM network, poor signal quality
Short off every 2 seconds (green, yellow or red) means roaming.
red, 1 blink per second - not registered, no signal or no network
red, 1 short blink in 2 seconds - SIM card not present
red, 2 short blinks in 2 seconds - bad PIN
red, 3 short blinks in 2 seconds - bad configuration file
red, 4 short blinks in 2 seconds - credit low

GPRS
green blinking, 1 per second - connecting
yellow - GPRS connected, TCP/IP connecting
green - GPRS and TCP/IP connected
red - disconnected, will try to connect again
off - no connection, GPRS disabled